REMARKS

Claims 19-24, 27-34, 37-39, 41-49, 51-60, 63-66, 76-88, 92, and 93 are pending in this application. Claims 19, 20, 37, 41, 42, 49, 54, 59, 63, 76 and 84 have been changed and claims 40, 48, 67-75, 89-91, 105-108 have been cancelled by this Amendment.

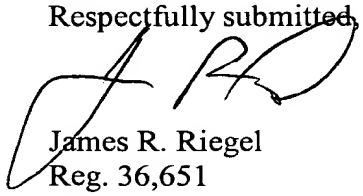
The Examiner rejected claims 19-24, 27-34, 37-49, 51-50, 63-92, and 105-108 under 35 U.S.C. §103(a) as being anticipated by Hollis Jr. et al. (U.S. Patent No. 5,146,566) ("Hollis"). Claims 67-75, 89-91 and 105-108 are believed patentable over Hollis, but have been cancelled by this amendment to expedite prosecution.

Claims 19, 41, 59, 63 and 76 are believed to be patentable over Hollis in their pre-amended form, but have been amended herein to expedite prosecution. Claim 19 has been amended to recite a z-axis actuator applying forces along a z-axis degree of freedom different from and substantially perpendicular to the two planar degrees of freedom. Claim 41 has been amended to include a z-axis actuator applying forces along a z-axis degree of freedom that is different and substantially perpendicular to the two planar degrees of freedom. Claim 59 has been amended to recite a z-axis actuator imparting forces along a z-axis degree of freedom different from and substantially perpendicular to the two planar degrees of freedom. Claim 63 has been amended to recite a z-axis actuator applying a tactile sensation to the user's hand along a z-axis degree of freedom different from and substantially perpendicular to the two planar degrees of freedom. Claim 76 has been amended to recite that the microprocessor receives desired force values from the host computer correlated with particular pointer locations displayed by the host. In a telephone conversation on August 3, 2001, these amendments were indicated to be allowable by the Examiner. Therefore, Applicant believes that claims 19-24, 27-34, 37-39, 41-49, 51-50, 63-66, 72-88, 92 and 93 are patentable over Hollis, and respectfully requests that the rejection under §103 be withdrawn.

A Supplemental Reissue Declaration reflecting the amendments made herein and the original bound copy of the issued Patent No. 5,790,108 are submitted herewith.

In view of the foregoing, Applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,



James R. Riegel
Reg. 36,651

San Jose, California
408-467-1900

MARKED-UP VERSION OF AMENDMENTS

In the Claims:

19. (amended) An interface device for enabling a user to spatially navigate a displayed graphical menu with a displayed graphical pointer, the graphical menu having a plurality of menu elements, and for enabling said user to more easily select a menu element from said graphical menu by providing tactile feedback to said user when said graphical pointer is moved from one menu element to the next menu element in said graphical menu, said interface device comprising:

(a) a handle to be manipulated manually by a user in at least two planar degrees of freedom;

(b) [an] a z-axis actuator generating tactile sensations to be felt by said user, wherein said z-axis actuator applies forces to the user's hand only along a z-axis degree of freedom when current is flowed through a portion of said actuator, said z-axis degree of freedom being different from and substantially perpendicular to said two planar degrees of freedom;

(c) a sensor that produces a locative signal responsive to and corresponding with the motion of said handle in said at least two degrees of freedom;

(d) a button that produces a status signal in response to being pressed by said user; and

(e) an embedded microprocessor local to said interface device and coupled to said sensor, to said button, and to said actuator, said microprocessor performing:

sending handle movement data and button data to a host computer over a communication bus such that said host computer can update displayed pointer locations with respect to said displayed graphical menu,

receiving desired force values from said host computer, said desired force values correlated with particular pointer locations displayed by said host computer, and

controlling said z-axis actuator in accordance with said received desired force values so as to provide said tactile sensations to said user that are correlated with the location of said displayed graphical pointer displayed within said graphical menu.

20. (amended) An interface device as recited in claim 19 wherein said z-axis actuator imparts said tactile sensations upon said handle along a z-axis orthogonal to said at least two degrees of freedom.

21. An interface device as recited in claim 19 wherein said handle is physically coupled to a support mechanism that is grounded and allows linear displacement between said handle and an origin.

22. An interface device as recited in claim 19 wherein said sensor is an optical sensor that includes an emitter and a detector.

23. An interface device as recited in claim 22 wherein said emitter moves when said handle is moved, projecting light upon said detector.

24. An interface device as recited in claim 23 wherein said detector detects motion of said light source in two mutually perpendicular directions.

27. An interface device as recited in claim 19 further comprising a memory that stores values that are representative of the locations of images displayed by said host computer.

28. An interface device as recited in claim 27 wherein said locations include the locations of icons displayed by said host computer.

29. An interface device as recited in claim 19 wherein said handle is a joystick.

30. An interface device as recited in claim 19 wherein said handle is a mouse.

31. An interface device as recited in claim 19 wherein said microprocessor receives display information from said host computer over said communication bus.

32. An interface device as recited in claim 19 wherein said tactile sensations include a viscous drag force.

33. An interface device as recited in claim 19 wherein said tactile sensations include an attractive force.

34. An interface device as recited in claim 33 wherein said attractive force is used to assist a user in positioning said displayed pointer into said graphical menu.

37. (amended) An interface device as recited in claim 19 wherein said [at least one] <u>z-axis</u> actuator is a flat coil actuator.

38. An interface device as recited in claim 37 wherein the magnet associated with said at least one flat coil actuator is fixed with respect to said origin and wherein the coil moves with respect to said origin.

39. An interface device as recited in claim 19 wherein said microprocessor receives code over a communication bus from a host computer and executes said code, said communication bus including a serial interface bus.

Please cancel claim 40 without prejudice.

41. (amended) A device for use in conjunction with a host computer including a computer display, said host computer displaying a graphical environment including a displayed graphical pointer controlled by said user, said device comprising:

a handle to be manipulated manually by a user in at least two planar degrees of freedom;

[an] a z-axis actuator to generate a tactile sensation to be felt by said user, said z-axis actuator applying forces to the user's hand only along a z-axis degree of freedom when current is flowed through a portion of said actuator, said z-axis degree of freedom being different from and substantially perpendicular to said two planar degrees of freedom;

a sensor that produces a locative signal responsive to and corresponding with a position or motion of said handle in said at least two degrees of freedom;

a button that produces a status signal in response to being pressed by said user; and

[an embedded microcontroller] control electronics local to said device and coupled to said sensor and said actuator and said button, said microcontroller performing the following:

sending handle movement data and button data to a host computer over a communication bus such that said host computer can update a displayed pointer location in said displayed graphical environment,

receiving a force value from said host computer, said force value correlated with said updated displayed pointer location, and

controlling said z-axis actuator in accordance with said received force value so as to provide said tactile sensation to said user that is correlated with the location of said displayed graphical pointer displayed within said displayed graphical environment.

42. (amended) A device as recited in claim [41] 54 wherein said microcontroller runs a program contained, at least in part, in memory coupled to said microcontroller, and wherein said memory also stores location information which corresponds with image data from a computer display coupled to said host computer.

43. A device as recited in claim 42 wherein said location information includes information relating to the location of an icon on said graphical display.

44. A device as recited in claim 42 wherein said location information includes information relating to the location of a window on said graphical display.

45. A device as recited in claim 42 wherein said location information includes information relating to the location of a graphical button on said graphical display.

46. A device as recited in claim 42 wherein said images include a cursor interacting with another object displayed on said computer display.

47. A device as recited in claim 46 wherein said cursor interacts with an icon image displayed on said computer display.

Please cancel claim 48 without prejudice.

49. (amended) A device as recited in claim [48] 41 wherein said at least two degrees of freedom are planar, linear degrees of freedom.

51. A device as recited in claim 41 wherein said microprocessor calculates force feedback forces based on commands received from said host computer.

52. A device as recited in claim 41 wherein said handle is moveable in a plane.

53. A device as recited in claim 52 wherein said handle is also moveable along a z-axis that is approximately perpendicular to said plane.

54. (amended) A device as recited in claim [53] 41 wherein said control electronics include an embedded microcontroller [said tactile sensation is applied along said z-axis].

55. A device as recited in claim 41 wherein said tactile sensation is applied to correspond with said displayed pointer interacting with a displayed graphical menu to enable said user to more easily select a menu item from said displayed graphical menu by providing tactile feedback to said user when said displayed graphical pointer is moved from one menu item to a next menu item in said graphical menu.

56. A device as recited in claim 41 wherein said tactile sensation is applied to correspond with said displayed pointer interacting with a displayed button.

57. A device as recited in claim 41 wherein said tactile sensation is applied to correspond with said displayed pointer interacting with a displayed window.

58. A device as recited in claim 41 wherein said tactile sensation is applied to correspond with said displayed pointer interacting with a displayed icon.

59. (amended) An interface device for use with a host computer displaying a graphical application on a display device, said host computer displaying, executing, and updating graphical objects in a graphical environment in response to user manipulation of said interface device and commanding force feedback sensations in response to said user manipulation and in coordination with said graphical objects, said graphical objects including a graphical pointer, the interface device comprising:

a physical object grasped and manipulatable by a user in two planar degees of freedom;

at least one z-axis actuator coupled to said physical object for receiving a force control signal and imparting forces along at least one degree of freedom of said physical object and in accordance with said force control signal, said forces applied along a z-axis degree of freedom that is different from and substantially perpendicular to said two planar degrees of freedom;

a sensor that detects motion of said physical object along said at least one degree of freedom and outputs signals relating to the position of said physical object;

a user-adjustable switch apparatus providing a state signal representing a state of said switch apparatus; and

a microprocessor local to said interface apparatus, separate from said host computer, and coupled to said host computer, to said sensor, and to said switch apparatus, said microprocessor receiving

force values from said host computer, said force values correlated with particular locations of said graphical pointer in said graphical environment displayed by said host computer,

said state signal from said switch apparatus, and

said signals from said sensor,

said microprocessor executing a process in parallel with said host execution of said graphical application and providing said force control signal to said at least one actuator to impart said forces in accordance with said received force values so as to provide tactile sensations to said user that are correlated with the location of said displayed graphical pointer.

60. The interface device claimed in claim 59 wherein said graphical objects include a displayed graphical menu, wherein said tactile sensations enable said user to more easily select a menu element from said displayed graphical menu by providing said tactile sensations to said user when said graphical pointer is moved from one menu element to the next menu element in said graphical menu.

63. (amended) A method for controlling a force feedback interface device using a host computer, said interface device manipulated by a user, a display device coupled to said host computer displaying a graphical user interface including images and updating said graphical user

interface in response to said manipulation of said interface device, said interface device conveying force feedback sensations to said user in response to said manipulations, the method comprising:

sending a position signal to said host computer, said position signal including information representative of the motion or position of a handle of said interface device in [a plurality of] two planar degrees of freedom, said handle being physically manipulated by said user, wherein said host computer updates the location of a cursor within said graphical user interface in response to said position signal;

receiving a force value from said host computer with a microprocessor local to said force feedback interface device, said force value correlated with said location of said cursor; and

controlling [one or more actuators] a z-axis actuator in accordance with said received force value to provide a tactile sensation to said user that is correlated with said location of said cursor in said graphical user interface, said tactile sensation being applied to the user's hand along a z-axis degree of freedom, said z-axis degree of freedom being different from and substantially perpendicular to said two planar degrees of freedom.

64. A method as recited in claim 63 wherein a sensor signal is input to said microprocessor, said microprocessor calculating said position signal based on said sensor signal, said microprocessor sending said position signal to said host computer.

65. A method as recited in claim 63 wherein said handle includes a joystick that can be moved by said user in two degrees of freedom.

66. A method as recited in claim 64 wherein said graphical user interface provides graphical objects for interfacing with an application program running on said host computer, said graphical objects including an icon, a window, and a menu.

Please cancel claims 67-75 without prejudice.

76. (amended) A human-computer interface device for controlling a graphical cursor displayed by a host computer and for providing tactile feedback to a user in accordance with displayed interactions between said cursor and other graphical objects displayed by said host computer, said interface device comprising:

a physical object to be moved by a user in two planar degrees of freedom;

one or more sensors that produce a locative signal responsive to and indicative of the position of said physical object in said two planar degrees of freedom;

a z-axis actuator that applies force to the user's hand only along a z-axis degree of freedom when current is flowed through a portion of said actuator, said z-axis degree of freedom being different from and substantially perpendicular to said two planar degrees of freedom; and

a microprocessor separate from and in communication with said host computer, said microprocessor coupled to said sensor and to said actuator, wherein said microprocessor receives [force information from said host computer and controls] desired force values from said host computer, said desired force values correlated with particular pointer locations displayed by said host computer, said microprocessor controlling current through said portion of said actuator in accordance with said received force values [information].

77. An interface device as recited in claim 76 wherein said two planar degrees of freedom are x and y axes parallel to a flat surface on which said interface device rests and said z-axis degree of freedom is substantially perpendicular to said x and y axes.

78. An interface device as recited in claim 76 wherein said interface device is a mouse device and wherein said physical object is a mouse.

79. An interface device as recited in claim 76 wherein said actuator includes a wire coil through which said current is flowed.

80. An interface device as recited in claim 79 wherein said actuator includes a magnet core.

81. An interface device as recited in claim 80 wherein said magnet core is an E-core.

82. An interface device as recited in claim 76 wherein said sensor is an optical sensor.

83. An interface device as recited in claim 82 wherein said sensor is an encoder.

84. (amended) An interface device as recited in claim 80 further comprising a permanent spring coupled between said [handle] physical object and said actuator.

85. An interface device as recited in claim 76 wherein said actuator is controlled to indicate when the cursor displayed on the host computer is moved from one displayed menu element to another displayed menu element.

86. An interface device as recited in claim 76 wherein said actuator is controlled to indicate when the cursor displayed on the host computer crosses a window boundary.

87. An interface device as recited in claim 76 wherein said actuator is controlled to apply said pressure to said user's hand to indicate when the cursor displayed on the host computer is positioned over a graphical element.

88. An interface device as recited in claim 76 wherein said actuator includes a portion that is moveable by said user along a z-axis to provide z-axis control to said host computer.

Please cancel claims 89-91 without prejudice.

92. An interface device as recited in claim 76 wherein a physical tactile element is physically coupled to said actuator and is moved to contact and apply pressure to said user's hand.

93. An interface device as recited in claim 92 wherein said physical element applies pressure upon the user's hand by pressing upward on said hand when said current is flowed through said portion of said actuator.

Please cancel claims 105-108 without prejudice.